Final Report
Time-Critical Removal
North River (former) Radio Relay Site, Alaska

March 2004

Prepared for:
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1.0 INTRODUCTION

This report describes the background, field work, and results of a time-critical removal conducted by the U.S. Air Force 611 Civil Engineer Squadron Environmental Operations (CEVO) between June and October, 2003 at the North River Radio Relay Site (RRS) (figure 1&2). The original purpose of this action was to remove POL contaminated soil from the vicinity of drums removed in 2002. Supplementary tasks, added to the project, were investigation of possible additional errant drums and tanks and other possible sources of environmental contamination, and identification of property boundaries by survey. In the process of the investigation, a high-concentration PCB spill was detected on the trail to a private allotment and cabin. Errant drums and POL-contaminated soil were identified at another site. Three areas (figure 3) and the activities within them are described. Year 2003 efforts consisted of soil removal in the vicinity of the removed drums at area B, removal of drums and some soil from area A, minor soil removal and sampling of PCB contaminated soil at the area C, and later full scale removal of 7.5 cubic yards of soil from area C. PCB contaminated soil remains in the high concentration area, pathway, and road in area C, and POL and PCB contaminated soil remain in area A.

1.1 Site History and Status

From 1958 to 1978, the USAF operated an Aircraft Control and Warning (AC&W) station and the North River Radio Relay Station (RRS) near Unalakleet, Alaska. As a result of these military activities, buildings, debris, and thousands of 55-gallon fuel drums were left in the area.

A Notice of Intention to Relinquish the Unalakleet Aircraft Control and Warning (AC&W) site was filed with the Bureau of Land Management (BLM) on 9 February 1970. On 1 December 1970, 618.01 acres were reported excess to GSA which subsequently retransferred the acreage to BLM for disposal. The former site is currently under the jurisdiction of BLM, subject to a village selection application by the Unalakleet Native Corporation.

In 1993 and 1995 all structures on the site were demolished but some fuel drums and miscellaneous debris remained on site.

1.2 Previous Investigations

Investigative, remedial and restoration projects for all Formerly Used Defense Sites (FUDS) in Unalakleet, Alaska by the United States Air Force (USAF) and the United States Army Corps of Engineers (USACE) Alaska District have occurred during 1984-1986, 1989, 1993, 1995, and 1999-2002. Previous investigations at the North River RRS include:

- In 1984 and 1985, hazardous and toxic wastes were removed from the Unalakleet AC&W Site by the Department of the Air Force.
- In 1986, the USACE investigated the site and published three sampling reports in 1989.
- An inventory report was prepared by Woodward-Clyde in March 1986.
- In 1989, a Remedial Investigation/Feasibility Study (RI/FS) was conducted, with options to include design work.

- In 1993 and 1995, two USACE contractors demolished buildings at the Unalakleet AC&W SITE and the North River RRS and buried all debris in an on-site landfill. However, according to the USACE Trip Report dated 10 July 2001, these cleanup projects did not dispose of all the fuel drums and miscellaneous debris scattered in the vicinity of Unalakleet.
- In 2001, the USACE performed a preliminary investigation of the sites that reportedly had fuels drums or debris. "Of 15 sites investigated, based on sample results and the site inspection, the team determined that six sites or areas had debris and contamination that could be cleaned up under DERP-FUDS."
- In 2002 a USACE contractor removed approximately 3,300 drums scattered in various areas across a 10 square mile area on ANCSA property as well as several Native allotments.

In June 2002 a reconnaissance by the USACE identified three drums of unknown product, possibly Contaminants of Concern (COC), in an area (area B) outside the area where a USACE contractor was removing approximately 3300 drums. USACE reported the existence of these drums to the U.S. Air Force. In August 2002 the possibility of more drums existing in the vicinity of these three was reported (Patrice Buck, Alaska Division of Environmental Conservation (ADEC), personal communication). Because of the potential for environmental contamination, USAF decided to conduct a time-critical removal of the identified drums and any identifiable contaminated soil in the vicinity of these drums. In September 2002, US Air Force 611 CES/CEVO personnel removed four drums and all obviously contaminated soil. Analysis of confirmation soil samples from the excavated areas indicated that two of the areas remained contaminated.

2.0 ENVIRONMENTAL SETTING

2.1 Geography

The Native Village of Unalakleet, Alaska, is located on the shores of the Norton Sound, on the west coast of Alaska, approximately 400 miles northwest of Anchorage. The former North River RRS was located on a hilltop about 12 miles, by road, southeast of and overlooking Norton Sound and Unalakleet. The site is located in Section 36, Township 18 South, Range 10 West, Kateel River Meridian and about 500 feet above mean sea level. The surrounding terrain is hilly alpine tundra, but the station lies on mostly gravel fill. An unnamed tributary of the North River flows about 1 mile north of the site.

2.2 Geology

The Unalakleet River basin is underlain by sedimentary bedrock consisting of graywacke, shale, grit, and conglomerate. Coarse clastic rocks form rubble-covered ridges and hills; shale underlies the slopes and valleys. The bedrock is tightly folded and in places is over-turned along fold axes that trend northeast. Large faults traverse the basin, both along the trend and across the trend of the folding. Two small intrusive bodies have been mapped- one in the divide at the head of the Chironskey River and the other on the south margin of the Unalakleet Valley between the Chironskey and Old Woman rivers. The only other bedrock unit mapped is a small outcrop of volcanic rocks in the extreme southeastern corner of the basin at the headwaters of Old Woman River. Fluvial deposits of silt, sand and gravel, and cobbles are found in streambeds, floodplains, and terraces (Sloan, et al., 1986).

2.3 Surface and Ground Water

Permafrost underlies most of the Unalakleet basin, but groundwater can be found in unfrozen alluvium in the stream valleys, most abundantly in the lower part of the tributaries and along the main stem of the Unalakleet River. Groundwater sustains river flow through the winter. Currently little groundwater is used within the basin (Sloan, et al., 1986). The village of Unalakleet, 8 miles downstream, receives its water from an infiltration gallery in Powers Creek, which is in a different watershed north of the village.

Late-winter low flow in the Unalakleet River basin is derived almost totally from groundwater discharge. Before the onset of snowmelt in the spring, streamflow is sustained by discharge of groundwater stored in alluvium adjacent to and underlying major streams. The quantity of base flow discharge in the Unalakleet River basin is directly proportional to the volume of unfrozen alluvium and bedrock that discharges to streams and indirectly proportional to the rate of water loss to ice storage and groundwater. Because of the presence of permafrost and low-permeability bedrock in most of the basin, groundwater is both recharged and discharged principally along stream courses in the alluvium. The absence of upland springs indicates that bedrock is not a major source of groundwater. Because the main stem of the Unalakleet River and the major tributaries generally are aligned along major faults, there is some possibility of interconnection of the alluvial aquifers with fractured bedrock buried beneath the valleys (Sloan, et al., 1986).

The North River WACS site is on a topographic high point. The top of the ridge was leveled to make a gravel pad for the site. Surface drainage is generally undeveloped, with precipitation runoff soaking into the ground or draining radially off the site by sheet flow. When the WACS facility was in operation, drinking water was obtained from a well northwest of the site, near the Little North River, a tributary of the North River (Sloan, et al., 1986).

Surface runoff that flows north and west of the site will drain to the Little North River, the source of drinking water for the site. Runoff from the WACS site, discharging into the Little North River, which flows through a valley 1 mile north of the WACS site, may travel over a drainage area of roughly 580 acres to the point of probable entry. The North River discharges into the Unalakleet River 4.5 miles west of the site. Discharge of the North River was measured at 120 cubic feet per second (cfs) in 1967. Surface runoff that flows south and east of the site drains to the Unalakleet River about 1/2 mile south. Drainage from the WACS site to the Unalakleet River may cover a drainage area of about 675 acres to the point of probable entry. The Unalakleet River enters Norton Sound 8 miles (map miles, not linear river miles) west of the WACS site. The discharge of the Unalakleet River was measured at 2,000 cfs in 1967. All streams in the area are characterized by low gradient and meandering courses, and are subject to seasonal flooding.

Surface water in the immediate area was used as a drinking water supply for humans, and may serve as water for wildlife. There are no known surface water intakes on either the North or Unalakleet rivers; however, this does not preclude their existence.

2.4 Climate

Unalakleet has a subarctic climate with considerable maritime influence, characterized by high humidity, considerable cloudiness, frequent fog, and light rain or snow, when Norton

Sound is ice-free. The freezing of the sound causes a change to a colder, more continental climate. Winter is cold and relatively dry, with an average of 41 inches of snowfall. Summers are cool, with most rainfall occurring during July through September. Mean annual precipitation is 14.0 inches, with 10.38 inches of rain falling during June (Information and Data Center [AEIDC], 1989 *from* CH_2MHILL, 1994). The 2-year, 24-hour rainfall is about 1.5 inches (U.S. Department of Commerce, 1963 *from* CH_2MHILL, 1994). Winter temperatures average between 11 °F and -40 °F, with an extreme low of -50 °F. Summer temperatures average between 62 ºF and 47 ºF, with a record high of 87 °F. Winds from the east predominate at Unalakleet; the average velocity is 11 knots.

2.5 Biology

2.5.1 Vegetation & Soil

Vegetation on the site is predominantly willows with some grass in the understory. The North River site is situated on the Norton Sound Highlands, an area generally characterized by soils of the Histic Pergelic Cryaquepts and Pergelic Cryunbrepts associations (Soil Conservation Service [SCS], 1979). These soils occupy broad high ridges, mountain slopes, valleys, and hill slopes and are generally well to poorly drained with shallow permafrost. The soils form in association with weathered rock, talus, and colluvial gravel deposits and consist of various loams containing silt, sand, and gravelly silt and a loam covered by a mat of organic soil. Permafrost exists at about 4 to 6 ft below the surface.

On the basis of EPA criteria for describing surface soil, soils of the North River site are considered to be predominantly medium-textured soils with moderate infiltration rates.

2.5.2 Wildlife

Diverse wildlife species are known to inhabit the areas surrounding the North River site. Moose, caribou and brown bear are generally distributed throughout these areas (ADF&G, 1986a). Peregrine falcons use the general area in spring and summer. Nesting areas are usually associated with major sea bird colonies, and no nesting sites have been identified**.** Common terrestrial birds of the area are spruce grouse, rock and willow ptarmigan, raven, parasitic jaeger, savannah sparrow, lapland longspur, snow bunting, and raptors such as the gyrfalcon, marsh hawk, merlin, snowy owl, rough-legged hawk, and golden eagle.

The Unalakleet River supports pink, chum, sockeye, coho, and chinook salmon. Salmon are present in Norton Sound from mid-June through August. Spawning in the river begins with chinook in early July and ends with coho from late August to late September. Dolly Varden and char are also present (ADF&G, 1986c). Both commercial and subsistence fishing, as well as subsistence hunting, are major components of Unalakleet's economy. Herring and king crab also are fished commercially.

The Unalakleet River is good habitat for waterfowl. Ducks, geese, and bird eggs are hunted for food.

2.5.3 Sensitive environments

Sensitive environments consist of environments that provide habitat for critical life stages, such as spawning and rearing, of various ecological species. A sensitive environment also includes habitat critical for the survival of threatened and endangered species. The Unalakleet River has been identified as a critical environment for anadromous fish species and, therefore, can be classified as a sensitive aquatic environment (Alaska Department of Fish and Game [ADF&G], 1986e).

2.6 Demographics

The town of Unalakleet has a population of 800. A local resident owns a cabin and native allotment about 1/2 mile from old RRS site and about 700 feet from the main road leading to the site. It is on the trail to this cabin that the PCB spill was detected.

After the Radio Relay Station was dismantled and razed in 1995, the land has been used for subsistence food gathering, specifically hunting and berry picking. For recreation, the high hilltop location is occasionally visited to view the area.

3.0 CURRENT PROJECT

The original objective of this project was to mitigate the potential for spread of contamination from POL contaminated soils and to investigate any other possible sources of contamination. In July 2003, USAF 611 CES/CEVO personnel removed soil at site B and visited two other sites indicated by local residents as being possibly contaminated (sites A & C). At these sites additional contamination was identified. Field activities are described below, by area, as depicted on figures 3-6.

3.1 Area A

3.1.1 Site Investigation

Errant drums were reported in area A. In this area USAF 611 CES personnel found nine 55-gallon drums, three of which contained product resembling used motor oil. Soil in the vicinity of these drums appeared to be contaminated with POL.

3.1.2 Soil and Drum Removal

In July 2003, nine 55-gallon drums were removed. Three of these drums were placed in 85-gallon overpack drums and were shipped to the Defense Reutilization Management Organization (DRMO) at Elmendorf AFB for disposal. Soil was removed from an obviously contaminated area and placed in five 85-gallon overpack drums, which were sent to DRMO for disposal. Sample analyses indicated that soil from this area remained contaminated with POL and one sample contained a low concentration of PCB. Additional sampling in August indicated a larger area of PCB contamination. Approximately 175 cubic yards of PCB-contaminated soil remain on this site. About 6 cubic yards of soil at this site contain POL (DRO/RRO) above cleanup goals.

3.1.3 Sampling

After drum removal and soil excavation in July 2003, 12 soil samples for laboratory analysis were taken from under drums and from the excavated area (figure 4, table 1, samples 1-12). These indicated that much of the area is contaminated with POL. One sample from the

excavated area was analyzed for PCB and contained 3.77 ppm Aroclor 1260 (PCB). In August, an additional 14 samples were taken for laboratory analysis of PCB (figure 4, table 1, samples 78-91). Five of these samples (one duplicate) contained PCB (Aroclor 1260) in concentrations between 7.63 and 122.0 mg/Kg. Six additional samples were taken for analysis using Dexcil Clor-n-Soil and L2000 analysis. Four of these samples contained PCB (as Aroclor 1260) in concentrations as high as 79 ppm. In September 2003, six more samples were taken from greater depths to help define the volume of contaminated soil (figure 4, table 1, samples 182-187). Four of these samples contained PCB (Aroclor 1260) in concentrations between 7.0 and 228 mg/Kg.

3.2 Area B

3.2.1 Soil and Drum Removal

In July 2003, one 85-gallon overpack drum (approximately 1 cubic yard) of POL-contaminated soil was removed from the vicinity of 2002 drum and soil removal (figure 5).

3.2.2 Sampling

In 2002, after removal of four drums and one drum of soil, four samples were taken for laboratory analysis, one from under each drum. The results of this sampling are presented in table 2. Two samples were found to contain 40,100 and 73,100 mg/Kg DRO respectively. They also contained RRO in concentrations of 14,200 and 22,900 mg/Kg respectively. During soil removal in July 2003, PetroFLAG analysis was used to guide excavation. Additional soil removal and confirmation sampling will be conducted at this site in summer 2004.

3.3 Area C

3.3.1 Site Investigation

In July 2003, a local resident of Unalakleet directed 611 CES/CEVO personnel to the site of an apparent stain and odor. At this site, along the trail to a private cabin, CEVO personnel visually identified an area about 20 feet in diameter that was apparently oil-stained and had the odor of Askarel (transformer oil) (figure 6). After soil removal, field-screen sampling revealed that an area about 35 feet by 45 feet is contaminated with PCB and Trichlorobenzene (two components of Askarel).

3.3.2 Soil Removal

In July 2003, four 55-gallon drums of soil were removed from the area of the “hot spot” and the remaining soil was sampled as described below. Based on the results of this sampling an additional visit was planned to remove a significant portion of the most highly contaminated material. In September, 2003, a track mounted excavator was used to remove approximately 24 cubic yards of soil and vegetation from the vicinity of the “hot spot”, all of which were placed in 61 drums (30 55-gallon open-top and 31 poly 85-gallon overpacks). All drums of contaminated material were staged in Unalakleet and transported to the Defense Reutilization Marketing Organization (DRMO) for disposal. Approximately 250 cubic yards of contaminated soil remain on the trail, road, and “hot spot” in this area. This area was then sampled using a TSCA grid method (EPA 1986) as described below.

3.3.3 Site Security

A synthetic non-permeable liner was placed over the main access road for 150 feet on each side of the intersection with the cabin trail. Six inches of clean fill material were placed on top of this liner. This action was undertaken to allow access to the area beyond, without further spreading the contaminant. In the future the fill and liner will be removed and the contaminated soil will be excavated.

One thousand-four-hundred feet of 6-foot-high chain-link fence was installed around the known contaminated area on the trail to prevent access by people or large animals. Signs warning of the danger of exposure to PCB were posted conspicuously on this fence. After contaminated soil is removed to below regulatory levels, this fence will be removed.

3.3.4 Sampling

After removal of four drums of soil from the grossly contaminated area in July, seven samples were taken for laboratory analysis (figure 6, table 3, samples 14 and 19-24). All contained significant amounts of Aroclor 1260 (PCB) with the highest containing 26,500 mg/Kg Aroclor 1260 and 447 mg/Kg Trichlorobenzene.

Based on the results of these samples, a systematic sampling of the spill area, the trail, and the main road, was conducted in August 2003. Forty five soil samples were taken from the trail leading to the cabin and from the main road leading to the RRS where the trail intersects it. The cabin trail was sampled for 390 feet from the road intersection; sampling ended approximately 270 feet from the cabin (figure 6, table 3, samples 32-58). The road was sampled for 100 feet on each side of the trail intersection (figure 6, table 3, samples 59-72). Trail and road samples were taken from the tire track where the spill was likely to have been carried. Samples were taken every 30 feet and samples from adjacent tracks were offset from each other by 15 feet. Samples were taken around the "hot spot" to identify the extent of the contamination in this roughly elliptical area (figure 6, table 3, samples 73-77). Road, trail, and "hot spot" samples were taken with the intent of defining the extent of the contamination. Sample results indicated that contamination (above 1 ppm) was more wide-spread than anticipated. Only 8 samples contained PCB concentrations lower than 1 ppm.

During the September visit, the remaining 270 feet of trail to the cabin and 300 additional feet (150 feet in each direction) on the main road were sampled (figure 6, table 3, samples 99-140). These indicate that contamination on the trail reaches to within about 25 feet of the cabin and extends sporadically along the main road for over 450 feet. After soil removal in the "hot spot" area, samples were collected using the EPA TSCA grid sampling method. A modified 19-point, 4-foot spaced grid was established over a roughly circular area yielding 28 samples (figure 6 inset). These samples were submitted to SGS/CTE for PCB analysis.

In September 2003, four samples of plant material were taken from leaves or roots of alder and willow trees in the vicinity of the "hot spot" and from near the cabin (table 3, samples 97, 98, 180, 181). These samples contained between 1.1 and 5.4 mg/Kg PCB.

Also during September, eight wipe samples were taken from surfaces in the cabin (table 3, samples 171-178). These indicated that no contamination has reached the cabin itself. Soil samples in the vicinity of the cabin also contained no PCB, except for one sample directly in front of the front door (table 3, sample 58 = 3.91 mg/Kg).

3.4 Sample Quality Assurance

Quality assurance objectives for this project are described in the Sampling and Analysis Plan. Guidance for this analysis is taken from the *Air Force Center for Environmental Excellence Quality Assurance Project Plan (QAPP), version 3.1*. In general, quality objectives include precision, accuracy, completeness, representativenes, and comparability as described below.

Precision

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations.

Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. This parameter usually applies to laboratory samples using spiked samples. It is impossible to know the actual value of field materials unless the entire deposit is analyzed.

Representativeness

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness is achieved through use of the standard field, sampling, and analytical procedures.

Completeness

The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified as "rejected" at the laboratory.

Comparability

Comparability is the confidence with which one data set can be compared to another data set. The objective is to produce data with the greatest possible degree of comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions and using standard and comprehensive reporting formats. Historical comparability is achieved through consistent use of methods and documentation procedures throughout the project.

3.4.1 Project specific results

All samples were labeled with date, time, sampler, preservative, and analysis requested. Chain-of-custody was maintained using paper forms and seals.

Completeness

Soil samples were taken to represent material on the main access road, trail to the cabin, high concentration area, and around the cabin. Vegetation samples were taken to indicate the possibility of contamination within various plants in the vicinity of the spill. Wipe samples were taken to determine if contamination exists within the cabin. Soil, vegetation, and wipe samples were sufficient in quantity and volume to accomplish these objectives. Of 186 samples, ten surrogates were out of range due to interference, 44 were out of range due to dilution and two were analyzed outside of the designated holding time. However, all sample results are usable.

Soil samples and vegetation samples were not taken from areas adjacent to the road or trail so these areas are not yet represented. This objective will be met during the 2004 field season.

Representativeness

Sample locations were chosen to properly represent the material present on the road, trail, the area within the high concentration area, and the surfaces of the cabin, based on professional judgment and TSCA guidance. The samples are deemed to be representative.

Precision and Comparability

These quality objectives can both be evaluated using the results of duplicate samples. Twelve "duplicate" soil samples were taken. These samples were actually co-located samples taken at the same time, rather than true duplicates from the same batch of soil. The Relative Percent Difference $\left(\frac{X_1 - X_2}{(X_1 + X_2)/2} \right)$ between duplicates for twelve samples ranged between 1.5% and 49.9% (sample pair #57 and #94). The average RPD was 10.6%.

The Correlation Coefficient is a number indicating the similarity in groups of paired numbers. The Correlation Coefficient for all "duplicate" samples and for each type of analysis (excluding the 57/94 pair) is shown in the following table.

	Correlation Coefficient
All Samples	0.997
PCB Samples	0.806
POL Samples	0.994

These indicate good correlation between the samples and their duplicates.

A paired Student T-test of the two (complete) sets of data (samples vs. duplicates) yields a "p" value of 0.094, indicating that the difference between the two sets is due to chance (the sets are statistically similar). This is verification that the duplicates are valid and that the samples are comparable. Because the samples and their duplicates are comparable, the samples are likely precise.

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Appendix A
Sample Analyses

Appendix B
Photos

Photo 1. Excavate & fill, Area C

Photo 2. Liner on main road before covering

Photo 3. TSCA sample grid - Area C

Photo 4. Wipe sampling cabin step

Response to ADEC comments on Draft Report

1. Comment: As I mentioned to Mr. Linne on the phone, the figures and tables were not included in the hard copy that was mailed to me. Please include them in the final document.
   Response: Done

2. Comment: Table 1. The sample ID numbers are not marked on this spreadsheet.
   Response: Formatting in the spreadsheet was insufficient for display – corrected.

3. Comment: Page 7, Section 3.2.2. Please address the following questions about the July 2003 soil removal at Area B. Why were confirmation samples not taken after this soil was removed? How much soil was removed? Has the excavation been filled with clean soil?

   Response: Confirmation samples were not taken due to a field operation oversight. One drum of soil was removed as stated in the first line of 3.2.2. The excavation has not been filled and will be examined in summer 2004 when additional soil will be removed and confirmation sampling conducted.

4. Comment: Figure 5. Please show the sampling results on this figure.
   Response: Done

5. Comment: Page 3.3.2. The first sentence states "In July 2003, four 55-gallon drums of soil were removed..." Please provide more information as to where this removed soil was originally located.
   Response: Added statements to this section.

6. Comment: Figure 4. This figure is difficult to understand. It is hard to tell the location of the PCB Sampling in relation to the POL Sampling. Perhaps it would be easier to understand if the sample information was put on one map and the sample concentrations were listed in tables with arrows pointing to the locations.
   Response: Modified figure.

7. Comment: Figure 6. It is not clear if the samples in the hot spot detail were taken before or after the hot spot removal was done in July or September 2003. Please clarify this in the text or on the figure.
   Response: Clarified section 3.3.2 and 3.3.4.